Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Service Rules for the 698-746, 747-762 and 777-792 MHz Bands	)	WT Docket No. 06-150
	)	
Former Nextel Communications, Inc. Upper 700 MHz Guard Band Licenses and Revisions to Part 27 of the Commission's Rules	)	WT Docket No. 06-169
	)	
Implementing a Nationwide, Broadband, Interoperable Public Safety Network in the 700 MHz Band	)	PS Docket No. 06-229
	)	
Development of Operational, Technical and Spectrum Requirements for Meeting Federal, State and Local Public Safety Communications Requirements Through the Year 2010	)	WT Docket No. 96-86

To: The Commission

COMMENTS OF ALCATEL-LUCENT

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SUMMARY

Alcatel-Lucent ("ALU") believes the Commission must adopt a broadband-only designation in the 700 MHz public safety spectrum to meet the future homeland security needs of the nation. Permitting operation of wideband technologies will only perpetuate the current shortcomings of today's public safety systems: limited, lower bandwidth applications, high cost of user devices, and limited interoperability. In the end, commercial broadband technologies are simply more capable and cost-effective than wideband technologies:

- **Higher Data Rates.** Broadband technologies are capable of supporting substantially higher data rates than wideband. For example, broadband technologies can support full-motion video (i.e. 30 frames per second), which requires data rates of approximately 500 kbps or greater. In contrast, wideband supports a maximum air interface bandwidth of 150 kHz and reliable user data rates of only 75-120 kbps.

- **Equal or Better Range.** At like data rates, broadband technologies provide connectivity at ranges comparable or better than wideband. ALU has shown, for example, that a broadband device can provide the same data rates as wideband over a 1,600 square miles in open area environment 20 times larger than Motorola claims.

- **Cost Advantages.** Commercial broadband technologies offer cost advantages and economies of scale over wideband technologies. In contrast, no similar "ecosystem" exists for wideband, and the size of the potential user base is vastly smaller. First responders deploying wideband networks would pay more and receive less, while stretching their scarce financial resources unnecessarily.

- **Greater Spectral Efficiency.** Broadband technologies unequivocally exhibit higher spectral efficiencies than wideband technologies for all wide area public safety data applications. Three 1.25 MHz channels reused by broadband public safety networks nationwide can carry roughly 10 times more data than can be carried on a patchwork of wideband networks using the same aggregate amount of spectrum.

Motorola has erroneously maintained that wideband offers superior capabilities, but its comparison relies on assumptions that are demonstrably faulty.

Providing “flexibility" to utilize wideband technologies will undermine interoperability, fragment the already small public safety market, increase the costs of providing ubiquitous, interoperable data communications, and hamper the ability of the public safety community to upgrade networks. Moreover, public safety agencies can retain autonomous operations even within a shared broadband network context with their ability to control and monitor network assets and to accept or deny network access based on user identity or roles.

With an exclusive public safety broadband designation in place, the Commission should move quickly to adopt a single commercial broadband technology as the nationwide interoperable standard. Such a plan should utilize a minimum channel size of 1.25 MHz, with the potential for aggregation up to 5 MHz.

ALU applauds the Commission’s tentative decision to consolidate the narrowband channels at the top of each of the public safety blocks. By reducing the amount of spectrum required for internal guard bands, more is made available for productive uses.

The redesignation of public safety wideband spectrum to broadband and the consolidation of narrowband spectrum in the upper portion of the public safety blocks afford the Commission an opportunity to optimize the technical rules for both public safety and commercial operations in the 700 MHz band. With the likelihood of similar architectures in the commercial and public safety broadband spectrum, the potential for commercial interference into the adjacent public safety spectrum is significantly reduced. The Commission, therefore, should consider lowering the out-of-band emission (“OOBE”) limits for commercial operations into the public safety broadband block and retain the existing emission limit for commercial operations falling into the public safety

narrowband block.

Although an internal guard band between public safety broadband and narrowband operations provides a sensible spectrum buffer, there is no basis for mandating a 1 MHz-wide guard band. The size of the guard band is most effectively determined through coordination between public safety broadband and narrowband licensee(s). The licensee can then assess how best to balance avoiding interference to the public safety narrowband operations and maximizing the amount of broadband capacity.

The Commission also must address border-specific issues promptly to ensure rapid roll out of new public safety services in these areas. First, public safety will require the ability to use the internal public safety guard band in border areas on a temporary basis while international uses are harmonized. Second, the FCC must seek temporary arrangements with the Canadian and Mexican governments that will facilitate roll out of these services until a new permanent international agreement can be forged.

Finally, the Commission should reject proposals that would place a condition on certain licenses in the 700 MHz commercial spectrum requiring a licensee to provide "open access." The Commission already has two proceedings that address these controversial issues, and the issues should be resolved there. Further, such mandates are not necessary and imposing those conditions only on these bands is misguided.

The Commission faces a historic opportunity to change state and local public safety communications for the better. By adopting the changes proposed in these comments, the Commission can seize this opportunity to make the Nation safer for all Americans.

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COMMENTS OF ALCATEL-LUCENT

Pursuant to Section 1.415 of the Commission's rules, 47 C.F.R. § 1.415, Alcatel-Lucent ("ALU") respectfully submits these comments in response to the Further Notice of Proposed Rulemaking ("*FNPRM*") in the above-captioned proceedings.[1] ALU commends the Commission for its ongoing commitment to ensure that our nation's first responders have access to interoperable broadband wireless communications. In particular, ALU strongly supports the Commission's tentative conclusion "to redesignate the public safety wideband spectrum for broadband use consistent with a nationwide

[1] Service Rules for the 698-746, 747-762 and 777-792 MHz Bands, et al. *Report and Order and Further Notice of Proposed Rulemaking*, FCC 07-72 (April 27, 2007) ("*FNPRM*").

interoperability standard, and to prohibit wideband operations on a going forward basis."[2] The Commission should promptly adopt a nationwide public safety broadband interoperability standard based on commercial broadband technologies to ensure public safety can leverage the innovation, economies of scale, and cost savings of the commercial sector. Such a plan should establish a minimum broadband channel size of 1.25 MHz and allow aggregation of multiple, 1.25 MHz channels within the 2x6 MHz public safety broadband spectrum. Additionally, the existing public safety narrowband channels should be consolidated in the upper portion of each public safety block in the 700 MHz band. With these changes, the Commission should also address certain technical issues to optimize both public safety and commercial operations in the 700 MHz band. These issues include rule changes governing an internal public safety guard band and out-of-band emission limits for commercial emissions falling into the public safety 700 MHz broadband block. Any band plan modification must address potential interference concerns along the Canadian and Mexican borders for public safety operations. With these modifications, the Commission will adopt a policy that revolutionizes public safety communications by fostering innovation and investment, securing interoperability, and launching a wide array of broadband services for first responders. Finally, for the commercial band, the Commission should decline to consider "open access" proposals in these dockets.

I. THE COMMISSION SHOULD ADOPT AN EXCLUSIVE BROADBAND DESIGNATION AND PROMPTLY ESTABLISH A NATIONWIDE INTEROPERABILITY STANDARD

ALU strongly endorses the Commission's tentative conclusion to replace the

[2] *Id.* ¶ 250.

wideband channelization scheme with a broadband-only designation.[3] As the *FNPRM* observes, there is a broad consensus regarding the importance of broadband technology to the public safety community.[4] Indeed, the Commission properly finds that a broadband public safety designation "would best serve [its] goal of enabling first responders to protect safety of life, health and property."[5]

A. AN EXCLUSIVE BROADBAND DESIGNATION IS ESSENTIAL TO SATISFY PUBLIC SAFETY'S SHORT- AND LONG-TERM COMMUNICATIONS NEEDS

As described below, commercial broadband technologies are more capable and cost-effective than wideband technologies. The Commission should act definitively and ensure that the 700 MHz public safety spectrum is put to its most effective, efficient use – through redesignation of minimum 2x5 MHz blocks exclusively for public safety broadband services.

1. Broadband Technologies Support Higher Data Rate Applications Than Are Possible with Wideband

Broadband technologies are capable of supporting substantially higher data rates than wideband. These higher data rates are essential to the first responder networks of today and tomorrow. Advanced, data-intensive applications – high-quality video streams, fast transmission of multiple, high-resolution images, and rich multimedia communications – simply require these high user data throughputs.

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[3] *Id.* ¶ 253.

[4] *Id.* ¶¶ 251-253.

[5] *Id.* ¶ 253.

Video streams provide an excellent example. Full-motion video (*i.e.* 30 frames per second ("fps")) requires very high data rates, *e.g.*, approximately 500 kbps or greater, to achieve the resolution quality typically found on Personal Digital Assistants ("PDAs").[6] All current broadband technologies, with air interface bandwidths in excess of 1.25 MHz, provide reliable data rates in excess of 500 kbps.[7] By contrast, wideband supports a maximum air interface bandwidth of 150 kHz and reliable user data rates of only 75-120 kbps —insufficient throughput to accommodate full-motion video.[8] Even lower quality, limited-motion video (*i.e.*, 15 fps), requires minimum data rates of 200 kbps and upwards.[9] Thus, a broadband system is essential to support these services.

Further, unlike broadband technologies, the limited data rates of wideband technologies are unlikely to be able to support applications that integrate multiple communications capabilities (video, audio, multiple data flows) into a seamless multimedia platform as will be required by first responders in the future.

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[6] Using a variety of compression and error resiliency techniques, state-of-the-art video codecs, such as MPEG-4, can achieve reasonable quality full-motion video over wireless links. The data rate required for transmission of a video stream is primarily a function of video frame rate (*i.e.*, the rate at which video frames are refreshed on a display) and screen resolution (*i.e.*, the number of pixels used to display the image). According to a SAFECOM report for tactical video based on a survey of public safety practitioners, the "desired frame rate" is 90 fps. SAFECOM, "Public Safety Statement of Requirements for Communications and Interoperability Vol II, Version 1.0" (2006). The resolution of liquid crystal displays used in the current generation of laptops and PDAs typically ranges between 80 and 120 pixels per inch. Thus, a typical 3 inch x 2.5 inch PDA screen has a resolution of around 320 pixels x 240 pixels. Assuming a frame rate of 30 fps at this resolution and an additional 32 kbps for the associated audio stream, an MPEG-4-encoded video stream requires a data rate of 468 kbps.

[7] *See Comments of Lucent Technologies, Inc.*, WT Docket No. 96-86, June 6, 2006 *("ALU 8th NPRM Comments"),* at 19 and Exhibit B (System Spectral Efficiency Comparative Analysis).

[8] *Id*. at 20.

[9] *See* note 6 *supra.*

2. Broadband Technologies Offer Equivalent or Superior Range Compared to Wideband

At like data rates, broadband technologies provide connectivity at ranges comparable or superior to wideband. Reliable coverage is an essential element of first responder communications, especially in underserved rural areas. Using EV-DO rev A as an example of wireless broadband technology, ALU has previously described how the cell range achievable with typical broadband systems for a *comparable* cell-edge data rate appears to be greater than that of Scalable Adaptive Modulation ("SAM").[10] An appropriately configured broadband network can achieve the same coverage as a SAM 150 KHz-wide channel system and additionally will support higher throughputs throughout the coverage area and higher capacities, all essential ingredients for mission-critical applications and operations.[11]

Motorola, the sole contributor of technical analysis in support of wideband in this proceeding, has consistently maintained that wideband offers superior range compared to broadband. Other commenters have repeatedly cited Motorola's claim as a fundamental reason in support of "flexibility" to allow both wideband and broadband deployment. As described below, Motorola's analysis is flawed, and its conclusions are far off the mark.

Motorola presents broadband projections that assume broadband systems will deploy omni antenna configurations.[12] *All* high-capacity commercial off-the-shelf

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[10] *See ALU 8th NPRM Comments*, Exhibit E (Range Analysis of EV-DO Rev. A and TIA-902.SAM) (comparing EV-DO Rev. A to the minimum required performance criteria specified for SAM in TIA-902.CAAB, "Radio Communications Performance Recommendations – Public Safety Wideband Data Equipment – Scalable Adaptive Modulation (SAM)" (2003)).

[11] *Id*. at 21-22.

[12] *See Ex Parte* Letter from Steve B. Sharkey, Motorola, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 96-86, Attachment at 4 (April 17, 2007) ("*Motorola April 17 Ex Parte"*).

("COTS") wide area broadband systems – including broadband technologies supplied by Motorola – employ sector antennas.[13] Sectorized deployments allow commercial broadband technologies to use advanced modulation and interference mitigation techniques, dramatically improving the capacity, data rates and spectral efficiencies achieved by broadband technologies. By ignoring this market reality and relying instead on the assumption that public safety broadband systems will be deployed using omni antennas, Motorola's sweeping conclusions regarding broadband coverage in rural areas, as well as other conclusions on transmission reliability and spectral efficiency of broadband compared to wideband are flawed.[14]

Motorola's resulting claims, therefore, must be dismissed. Motorola is wrong, for example, when it claims that "Wideband Data Enables Large Coverage Areas with Fewer

[13] According to Motorola's high-level product description: "The SC4812T-MC base station is designed for optimum efficiency in medium to high capacity cell sites. Multicarrier operation enables dynamic power allocation across both sectors and carriers for maximum power efficiency and flexibility. RF power is allocated across all sectors and carriers based on traffic loading. Likewise, channel pooling across carriers and sectors allow channel resources to be dynamically allocated based on traffic loading. This allows the cell site to handle traffic that would otherwise go unserved. The result is an increase in operational flexibility, a higher effective power, and a higher grade of service." *See* www.motorola.com.

[14] In its Reply Comments in the 8th NPRM proceeding, Motorola stated that Lucent Technologies' analyses were flawed essentially because total transmit power, rather than traffic power, was used in the range calculation. Reply Comments of Motorola, Inc., WT Docket No. 96-86 at 11 (July 6, 2006) ("*Motorola 8th NPRM Reply Comments*"). Motorola is wrong. Since link budgets can be arranged in a number of ways, fraction of transmit power allotted to overhead is accounted for in our determination of the required Eb/Nt value for particular data rates. Second, Motorola's base station may be characterized by a 6 dB noise figure; ALU's base station presents a 4 dB noise figure. Third, when asserting that sectorization can also be used for wideband deployment, Motorola fails to mention it will reduce the number of users that can be served per sector. On the other hand, since the comparison was with cdma, Motorola is well aware that 3-sector deployment is the common practice with cdma networks. Fourth, while the amount of loading can be controlled, rural areas are likely to be lightly loaded leading to a reduction in noise rise and hence, an increase in range. However, if, by Motorola's argument, maximum loading were to be used to meet worst-case needs, a wideband base station deployed in rural areas should be equipped with multiple radios, hence driving its cost higher.

Sites – Covers 700 sq. mi vs. 80 sq. mi for High Site Broadband."[15] ALU's comments in response to the 8th NPRM clearly show that a 200 mW broadband device is capable of reliably achieving data rates in excess of 130 kbps over a coverage area greater than 1,600 square miles in an open area environment -- 20 times larger than the 80 square miles in Motorola's claim.[16] A detailed list of assumptions is included in ALU's analysis. No such transparency is provided in Motorola's contributions.[17]

Ultimately, Motorola's advocacy obscures this simple reality: public safety will choose a deployment scheme for data services that is a compromise between the desire to achieve a 1:1 overlay with narrowband systems – thereby minimizing infrastructure deployment costs – and the desire to achieve maximum data rates at the cell edge. For example, urban network designs are likely to be based on a higher edge rate than in rural areas. Under these circumstances, broadband technologies offer distinct advantages over wideband. First, it is undeniable that broadband can achieve a higher aggregate throughput throughout the cell coverage area with cell-edge data rates comparable to a wideband offering. Moreover, broadband systems can achieve additional range increases through the use of techniques such as tower top amplifiers, fiber-linked RF heads,

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[15] *Motorola April 17 Ex Parte*, attachment at 5.

[16] *See* Table 2 in Exhibit E of *ALU 8th NPRM Comments* and the supporting analysis. Furthermore, in its reply comments in response to the *8th NPRM*, Motorola used a mobile (wideband) transmit power level of 10 W when comparing link budgets with EV-DO, where transmit power levels are roughly 300 mW. *Motorola 8th NPRM Reply Comments*, Appendix A. Due to the large batteries required for such high power levels, 10W devices will only be available in mobile (e.g., trunk-mounted) form factors. It is highly unlikely that portable wideband terminals, such as portable digital assistant (PDA), will be produced with a 10 W RF transmitter because range capability must be balanced with power consumption and battery life. The power consumption of a 300 mW device will be far lower than that of a 10 W device. The Katrina disaster has shown that end-user device power reliability is of significant importance. High power devices are a liability in such scenarios.

[17] The lack of public information about SAM, moreover, limits the ability of third parties and policymakers to assess its capabilities and attributes.

multiple-input multiple output antennas, intelligent antennas and greater-than-three sectorization.[18] In contrast, with the exception of tower top amplifiers, none of these options is likely to be deployed in the wideband context due to the limited scale economies in the wideband market. As a result, broadband technologies are the right answer for first responders concerned about the effective coverage range of their systems.

3. Commercial Broadband Technologies Are More Cost-Effective Than Wideband

Commercial broadband technologies offer cost advantages and economies of scale that wideband technologies simply cannot match.[19] For example, ever-growing numbers of manufacturers are developing commercial broadband products for an ever-expanding subscriber base, creating a highly competitive "ecosystem" that drives constant economies of scale and brings prices down.

By contrast, *no* such commercial "ecosystem" exists with respect to wideband technologies, and the size of the potential user base is vastly smaller. The market for wideband will be smaller still if wideband deployments are confined to rural areas. As a result, wideband systems that would be used by public safety entities are certain to be more expensive than broadband systems, just as current narrowband public safety communications equipment is substantially more expensive than broadband

[18] Such techniques provide significant additional gain to the link budget and capacity increases for some systems. Tower top amplifiers are a common technique that can be used with any radio technology when the inbound link is the limiting factor. Fiber-linked systems are essentially base stations whose radio units sit near antennas, and are connected to the baseband unit of the base station via fiber links, avoiding the usual attenuation from antenna-to-base cable + base station jumper combination. Greater-than-three sectorization, intelligent antennas and multiple-input-multiple-output are advanced options which can greatly improve range and capacity of a wireless system.

[19] Reuse of existing hardware, software and manufacturing and control processes drive economies of scale.

communications equipment manufactured in massive quantities for the consumer market. In effect, first responders deploying wideband networks will pay more and receive less, while stretching their scarce financial resources unnecessarily. For example, because of limited spectrum resources, capacity growth in wideband systems could only be achieved through onerous improvements such as cell-splitting.[20] The Commission should heed the lessons of the past and enable greater use of robust, more efficient and cheaper commercial standards by public safety.[21]

In addition, all commercial broadband technologies are inherently designed to offer enhanced voice and data interoperability and any evolution will allow for backward compatibility. As a result, public safety would be able to upgrade systems without being forced to replace all devices at the same time. This enhanced functionality makes commercial broadband technologies an ever more cost-effective, and obsolescence-proof, solution for first responders.

4. Broadband Technologies Offer Significantly Greater Spectral Efficiency and Data Carrying Capacity than Wideband

Broadband best advances the goal of spectral efficiency. Over the years, first responders consistently have called for more spectrum to accommodate their communications needs. By allowing the use of broadband technologies in the 700 MHz

[20] Cell-splitting is very costly upgrade route for wideband since it consists of constructing additional towers, and deploying new equipment. Cell splitting reduces the area of a cell cluster, thereby increasing system capacity.

[21] See, e.g., Remarks of FCC Commissioner Robert M. McDowell, Catholic University School of Law Symposium, March 15, 2007 (prepared remarks at 13) ("By using the latest proven and reliable commercial off-the-shelf technologies, [ ] public safety agencies – and, more importantly, the taxpayers who fund them – are benefiting from the considerable discounts associated with economies of scale.").

public safety band, the Commission provides first responders with a unique opportunity to make more efficient use of their spectrum resources today and into the future.[22]

Broadband technologies are uniquely suited to provide first responders with greater spectral efficiencies than wideband technologies, including SAM, by enabling all assigned channels to be used in every cell throughout a broadband network—*i.e.*, frequency reuse of one.[23] Such tight frequency reuse, which is not possible with SAM, enables a broadband network to carry higher total volumes of data, thus allowing more simultaneous users to send and receive more data than is possible with technologies that cannot accommodate a frequency reuse of one. By contrast, in a SAM network, if a particular frequency is utilized in one cell, the same frequency cannot be used in nearby cells and sectors but instead must lie fallow.[24] As a result, three 1.25 MHz channels reused by broadband public safety networks nationwide can carry roughly 10 times more data than can be carried on a nationwide patchwork of SAM networks using the same aggregate amount of spectrum.[25] The first responders of tomorrow will need that spectral efficiency to meet their expanded connectivity demands.

Contrary to recent claims by Motorola, broadband technologies *unequivocally* exhibit higher spectral efficiencies than wideband technologies for *all* wide area public safety data applications – messaging, database queries, automatic vehicle location, meter reading, fingerprints, mug shots, reports, intra/internet access, image distribution,

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[22] Although SAM appears to meet the FCC requirement, on a per channel basis, of 384 Kbps/150 KHz, that does not make a SAM *system* spectrally efficient compared to technologies such as broadband which allow for a more optimal use of the shared band.

[23] *See ALU 8th NPRM Comments* Exhibit B, at 4-5.

[24] *Id.* at B-4 figure 1.

[25] *Id.*Exhibit B.

buffered video, remote camera, office applications, over-the-air programming, etc.[26] Again, Motorola's analysis does not comport with the facts. First, in making its claims, Motorola avoids the commonly accepted definition of system spectral efficiency – the mean data carrying capacity of a cell divided by the total spectrum consumed. Further, as noted above, Motorola's claim is premised on the underlying assumption that broadband deployment will use omni antennas – even though Motorola and all other manufacturers employ sectorization for their wide area COTS broadband deployments. Motorola's 'hybrid technology' solution approach promoted by its multiple tiers of applications is misleading at best. ALU and Qualcomm, in contrast, clearly demonstrate the superior spectral efficiency of broadband over wideband in their comments to the *8th NPRM*.

As a result of the higher capacities achieved with broadband technologies, more public safety personnel can be supported at the scene of an emergency than is possible with wideband, and more data-intensive applications can be accessed by each user. As incontrovertible evidence of the superiority of broadband over wideband, the commercial wireless sector has moved from wideband-like to broadband technologies. This move has been driven by the same benefits public safety will experience through adoption of broadband: better or similar range, higher capacity, support of multimedia applications and lower or similar cost of deployment and operations.

[26] *Motorola April 17 Ex Parte*, Attachment at 9. Motorola erroneously asserts that "WB is more spectrally efficient than BB" for "most tier 1 to 3 application data rates," where "Tier 1" applications refers to applications requiring 9.6 kbps or less, "Tier 2" Applications refers to applications requiring 96 kbps, and "Tier 3" applications requiring 100 to 500 kbps. Motorola's analysis was based on the incorrect premise that the broadband link budget performance was inferior to wideband's link budget, as discussed above.

5. Broadband Technologies Offer a Higher Level of Interoperability than Wideband

As designed by Congress and implemented by the Commission, interoperability is one of the key public policy imperatives in the 700 MHz band.[27] This imperative arose because, to date, the interoperability of public safety networks has been limited due to the large number of proprietary technologies developed for use in the different public safety bands. To solve interoperability in the commercial context, broadband technologies have developed a highly structured framework premised on the following key elements that can also deliver interoperability for public safety:

- The network can distinguish among user devices to determine the air interfaces, services, and data rates supported by a particular device and deliver mobile services in the most efficient manner possible given the device. Such capability enables backward compatibility as networks evolve.
- Common sets of services (*e.g.*, user authentication, mobility management, encryption key exchange, over the air programming) are supported on all air interfaces.
- Complete definition of an open-standard network architecture with standard interfaces to provide cross-vendor interoperability.[28]
- Support of legacy devices on the same air interface as that technology evolves.[29]

Further, commercial broadband technologies also enable interoperability through the use of IP Multimedia Subsystem ("IMS"). IMS, while not mandatory for

[27] *See* Deficit Reduction Act of 2005, Pub. L. No. 109-171, Sec. 3006, 120 Stat. 24 (2006).

[28] While omnipresent in the suite of standards developed for commercial technologies, cross-vendor interoperability was not the norm in the public safety world (with the exception of TETRA) until recently with the development of the ISSI for P25. Moreover, in a market dominated by a single wideband vendor, cross-vendor interoperability is meaningless. In addition, no independent laboratory is recognized or mandated to issue cross-vendor interoperability reports.

[29] See *ALU 8th NPRM Comments* at 21.

interoperability, provides a beneficial common open-standard architecture and consistent set of services to be provided over a network regardless of the air interface used by a particular device.[30] Importantly, IMS has been accepted by standards bodies for the two primary mobile wireless broadband technologies deployed today, cdma2000 and UMTS. IMS supports seamless roaming across commercial wireless networks (including WiFi networks) and dedicated public safety networks employing commercial broadband technologies. Moreover, the common framework employed by IMS can be used to support future air interface technologies and provides for full-featured interoperability of Internet protocol ("IP")-based applications, without requiring dedicated interoperability channels. In sum, public safety interoperability will benefit from the synergies created by the widespread and competitive commercial broadband user and vendor community.

B. PERMITTING MIXED DEPLOYMENT OF BROADBAND AND WIDEBAND UNDERMINES PUBLIC SAFETY CAPABILITIES

ALU strongly supports the Commission's view that a broadband-only designation will result in greater benefits over the long-term than mixed-use channelization or flexibility of the band. Some commenters have recommended that the Commission provide the option of using wideband or broadband.[31] Whereas flexibility is typically recognized as a virtue in the commercial context because it enables markets to develop more robust and cost-effective technologies, the same marketplace disciplines do not apply in the command-and-control public safety environment. In fact, "flexibility" to

[30] IMS has been adopted by the world's primary commercial broadband wireless technologies: cdma2000 (which includes EV-DO) and UMTS. IMS is a collection of logical entities with standard interfaces to manage session control, media resources, and applications.

[31] Supporters of flexibility largely relied on the erroneous perceptions of range and cost described above.

utilize wideband technologies will undermine interoperability, fragment the already small public safety market, increase the costs of providing ubiquitous, interoperable data communications, and hamper the ability of the public safety community to upgrade networks as commercial broadband technologies evolve. The *FNPRM* properly concluded that such flexibility would "perpetuat[e] a balkanization of public safety spectrum licenses, networks, and technology deployment" at the expense of efforts to deploy a nationwide, interoperable broadband network.[32]

Mixed-use of the band will undermine interoperability because it will allow the proliferation of "islands" of wideband deployments that will not be interoperable with more prevalent broadband equipment. A single local decision to deploy wideband could jeopardize or delay regional or even national interoperability. For example, if the Commission permits the coexistence of broadband and wideband technologies in the 700 MHz public safety band, the public safety community will be forced to clear spectrum of wideband uses before upgrading to advanced broadband technologies as they are developed, including, in particular, broadband technologies that aggregate multiple channels. This will be a very costly and highly complex undertaking. The resulting fragmentation of the 700 MHz band due to sporadic wideband applications will prevent the aggregation of the increasingly large number of contiguous frequencies that future broadband technologies are likely to require. Multiple incompatible standards will only further delay the key public policy goals for the band.

[32] *FNRPM* ¶ 253.

Further, to achieve interoperability in a mixed-wideband/broadband environment, multi-mode terminals will need to be developed.[33] As Qualcomm has explained, however, given the limited size of the public safety market, the initial development of such multi-mode terminals will take a considerable amount of time and impose significant costs.[34] Such added complexity and expense comes without any discernible benefit to public safety. Moreover, going forward any multi-mode terminals also will not take advantage of the competitive synergies and backward-compatibility that characterize the commercial broadband marketplace. As the Commission noted, "only through use of broadband networks could public safety leverage advanced commercial technologies and infrastructure to reduce costs and speed deployment."[35]

Moreover, public safety agencies can retain autonomous operations even within a shared broadband network context. In a shared broadband network (or network of networks) public safety agencies will have the ability to control and monitor network assets, accept or deny network access based on user identity or roles, and provide other levels of logical control that is today provided through deployment of stove-piped single-agency networks in physically separate spectrum[36] Thus a broadband-only deployment will actually enhance local control.

In addition, the use of shared broadband networks will encourage cooperation and foster communications interoperability among different agencies through, for example,

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[33] *See Ex Parte* Letter from Michael T. McMenamin, Alcatel-Lucent, to Marlene H. Dortch, Secretary, FCC, WT Dockets 06-169 and 96-86, (March 21, 2007), attachment at 3 ("*ALU March 21, 2007 Ex Parte*").

[34] *Qualcomm June 6, 2006 Comments* at 36.

[35] *FNRPM* ¶ 253.

[36] The role of Regional Planning Committees has always been of coordinating and managing radio resources, and not of selecting technologies.

development of common operating procedures and use of common applications. A broadband-only designation will result in great strides in interoperability technology and process.

C. A SINGLE NATIONWIDE INTEROPERABLE STANDARD BASED ON COMMERCIAL BROADBAND TECHNOLOGY WILL LEVERAGE COMMERCIAL INNOVATION AND ECONOMIES OF SCALE

The *FNPRM*'s tentative conclusion to redesignate public safety spectrum for broadband use repeatedly emphasized that only broadband systems consistent with "a nationwide interoperability standard" should be deployed.[37] ALU strongly endorses this approach and urges the Commission to move quickly to adopt a single commercial broadband technology as the nationwide interoperable standard.

The advantages of mandating a single, commercial broadband technology are substantial.[38] Adoption of a single commercial broadband technology will enable the public safety community to benefit from the decades of innovation funded by the private sector, as well as the substantial economies of scale available to the commercial markets. Driven by the competitive need to deploy new, revenue-generating services, commercial wireless providers and their technology vendors continually push the cutting edge of wireless technology. By contrast, first responders simply do not have the market size or sufficient funding to support independently the extensive research and development necessary for continuing innovation. This is clearly demonstrated by the substantial

[37] *FNPRM* ¶¶ 11, 174, 250, 253, 257, 262.

[38] Unlike in the public safety sector, technology mandates are not warranted in the commercial sector. The vast size and highly competitive nature of the commercial wireless market forces commercial wireless providers to manage spectrum resources efficiently and provide cross-carrier interoperability. These market-disciplining characteristics of the commercial sector are not present in the public safety sector.

difference in functionality between current public safety communications systems and the far more advanced, more flexible, and less expensive commercial services that the vast majority of Americans have come to take for granted. The standardization required by commercial wireless providers results in massive economies of scale, which can dramatically reduce the cost of network infrastructure and end user devices.

Of note for public safety, the market-driven dynamic between equipment purchasers and a competitive pool of manufacturers and software developers ensures that future advances in broadband technology have a high degree of backward compatibility with previously deployed networks.

As an initial step, ALU proposes the use of a minimum channel size of 1.25 MHz, with the potential for aggregation up to 5 MHz. A 1.25 MHz channel size can accommodate practically all current and future mobile broadband technologies including cdma2000 EV-DO (all revisions), UMTS LTE and IEEE 802.16e. Aggregation of multiple 1.25 MHz blocks into 5 MHz blocks allows the support of additional commercial broadband technologies as detailed in this proceeding.

Once a standard has been adopted, state and local jurisdictions can build regional networks constructed according to commercially-standardized technical and performance standards established, forming a “network of networks” in order to ensure nation-wide interoperability. These regional networks would interoperate through roaming agreements with the national licensee and other regional public safety broadband networks, and possibly commercially deployed wireless operators using similar technology. This approach also has the advantage of enabling extended coverage and redundancy capabilities through roaming agreements with existing commercial networks.

All these benefits could be squandered, however, if by failing to adopt a single commercial standard quickly the Commission permits a hodgepodge of air interfaces to proliferate within the public safety market. Public safety needs interoperability. The Commission should act quickly to establish a single nationwide interoperable standard so that first responders will be able to realize the benefits of commercial technologies at the earliest possible time.

II. THE COMMISSION SHOULD CONSOLIDATE PUBLIC SAFETY NARROWBAND SPECTRUM IN THE UPPER PORTION OF THE PUBLIC SAFETY SPECTRUM BLOCKS

ALU applauds the Commission's tentative decision to consolidate the narrowband channels at the top of each of the public safety blocks, rather than deploying the narrowband channels as bookends along the edges of each of the two public safety blocks. As the record amply demonstrates,[39] the Commission should adopt this narrowband channel consolidation because it reduces the amount of spectrum required for internal guard bands. Specifically, instead of needing internal public safety guard bands on both sides of the wideband/broadband data block, only a single guard band is required, thereby increasing overall spectrum efficiency and making more spectrum available for productive uses. Most important in the short term, consolidation of narrowband spectrum will reduce the potential for intermodulation distortion in narrowband receivers.[40] Narrowband consolidation is an essential component to the

[39] *FNPRM* ¶ 256.

[40] *ALU March 21, 2007 Ex Parte*, attachment at 5; *ALU 8th NPRM Comments*, Exhibit G (Protection of Narrowband Operations); *Reply Comments of Lucent Technologies Inc*., July 6, 2006, WT Docket No. 96-86, at 2-3. If narrowband consolidation takes place, new narrowband LMR devices are expected to be designed with a new RF front-end which should reduce further the risk of intermodulation.

deployment of broadband in the commercial and public safety portions of the 700 MHz band.

III. THE COMMISSION SHOULD CONSIDER MODIFYING 700 MHZ TECHNICAL RULES IN LIGHT OF THE PUBLIC SAFETY BROADBAND DESIGNATION AND NARROWBAND CHANNEL CONSOLIDATION

The redesignation of public safety wideband spectrum to broadband and the consolidation of narrowband spectrum in the upper portion of the public safety blocks afford the Commission an important opportunity to reassess and optimize some key technical rules for both public safety and commercial operations in the 700 MHz band.

As an initial matter, through use of cellular-type architectures, *i.e.*, low-power, low-height infrastructure, in the public safety broadband spectrum, public safety will be able to leverage more effectively the commercial broadband technologies, as identified above, as well as potential use of commercial infrastructure.

Spectrally adjacent commercial systems will pose less of a threat of interference to the essential public safety narrowband services as a result of the shift of narrowband channels and the placement of the broadband allocation adjacent to commercial broadband spectrum. Further, with the likelihood that similar architectures will be deployed in the commercial and public safety spectrum, the potential for commercial broadband interference into the adjacent public safety spectrum is significantly reduced. The Commission, therefore, should relax the out-of-band emission ("OOBE") limits applicable to the commercial emissions falling into the public safety block. In particular, the Commission should consider lowering the current 76+10logP in 6.25 KHz OOBE rule (equivalent to 54+10logP in 1 MHz) for commercial operations into the public safety broadband block to levels that are comparable to OOBE rules applicable to adjacent

blocks in commercial spectrum.[41] The Commission can retain the 76+10log10P emission limit for commercial operations falling into the public safety narrowband operations, but this limit is less significant due to the large separation between the commercial and public safety narrowband operations.

The Commission should also carefully consider how best to manage potential interference from public safety broadband operations into the public safety narrowband spectrum. ALU agrees with the Commission's tentative conclusion to adopt an internal guard band between public safety broadband and narrowband operations – but questions the proposal to mandate a 1 MHz-wide guard band.[42] The Commission should leave the decision to the public safety broadband spectrum licensee(s) to determine the size of the guard band required, taking two factors into account: avoiding interference to the public safety narrowband operations and maximizing the amount of broadband capacity. The size of the guard band will ultimately vary depending on OOBE limits, the nature of the narrowband operations, and whether collocation is feasible or not. ALU proposes that the Commission adopt an OOBE limit of 76+10logP for public safety broadband operations into the narrowband operations, which will go a long way towards ensuring narrowband operations receive adequate protection.[43] This proposal is summarized in

[41] *FNPRM* ¶ 258. For comparison, a 43+10logP (in 100 KHz) OOBE rule is applied in the commercial 850 MHz cellular band.

[42] *Id.* ¶¶ 250, 257.

[43] Product capabilities (non-linearities) will dictate how far apart (in frequency) broadband and narrowband can operate for a given OOBE limit. The way OOBE limits are calculated must take into account the way narrowband systems will be deployed. A P25 designed for a DAQ (Digital Audio Quality) of 3.4 will call for a less stringent OOBE than a system designed for a DAQ of 3 and so would a P25 system designed for 45 dBµ instead of 40 dBµ at the edge of coverage, for example.

Figure 1.[44]

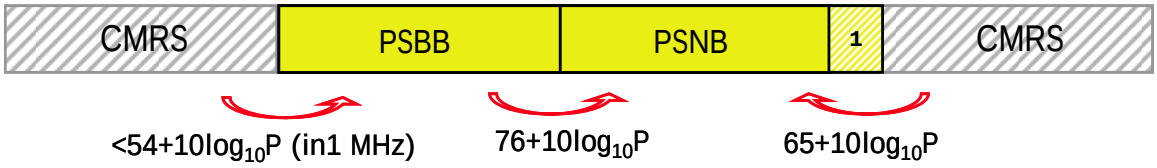

Figure 1 OOBE Limits

Through adoption of these revised limits, the Commission can optimize the utility of this public safety band for all applications.

IV. THE COMMISSION SHOULD ALLOW LIMITED NARROWBAND USE OF THE INTERNAL PUBLIC SAFETY GUARD BAND IN BORDER AREAS AND QUICKLY WORK TO UPDATE INTERNATIONAL AGREEMENTS

The Commission must address border-specific issues promptly to ensure rapid roll out of new public safety services in these parts of the country. First, public safety will require the ability to use the internal public safety guard band in border areas on a temporary basis while international uses are harmonized. Second, the FCC must move swiftly to seek temporary arrangements with the Canadian and Mexican governments that will facilitate roll out of these services until new permanent international agreements can be forged.

In Canadian border areas, a reconfiguration of the band plan for the 700 MHz Public Safety spectrum may result in the relocated narrowband channels being blocked by Canadian TV broadcasters.[45] Specifically, although the Canadian government has agreed to clear broadcasters from TV channels 63 and 68, and assign those channels to

[44] The Commission's current rule imposes an OOBE limit of 65+10logP for operations above the public safety band. 47 C.F.R. § 27.53(c)(4).

[45] *FNPRM* ¶ 260.

emergency services, there is no such agreement for TV channels 64 and 69. Because the Commission tentatively concluded that it will consolidate the public safety narrowband channels onto TV channels 64 and 69, narrowband channels in border areas will be subject to interference from Canadian broadcast operations during Canada's DTV transition unless additional measures are taken. In the case of operations along the US-Mexico border, although the current agreement does not refer to public safety services *per se*, there are a number of primary assignments that impact deployment of broadband systems.[46] For both borders however, primary users, be they public safety agencies or TV stations, are to be protected from interference but could also interfere (with non-primary users) even when within technical limits set forth in the agreement.

As set forth in the *FNPRM*, band plan proposals 3, 4, and 5 consider shifting the whole public safety band down by 1 MHz. This shift would allow a portion of the narrowband operations to overlap with TV channels 63 and 68, which will be cleared on both sides of the U.S.-Canadian border. This 1 MHz shift, however, will result in new international coordination concerns as public safety broadband operations would be shifted into existing channels 62 and 67 – which also have Canadian television station operations, at least for now. This ultimately could yield poor utilization of the public safety broadband block in order to manage effectively the interference from and to TV services. Using information from the FCC website, a review of Canadian TV activity at channels 62 and 67 indicates the presence of a number of TV stations in high demand and in highly populated areas. The map in Figure 2 is a depiction of the US-Canada border in

[46] Nonetheless, the most potentially troubling ramifications from border operations are along the Canadian boundary.

the most crowded sectors.[47]

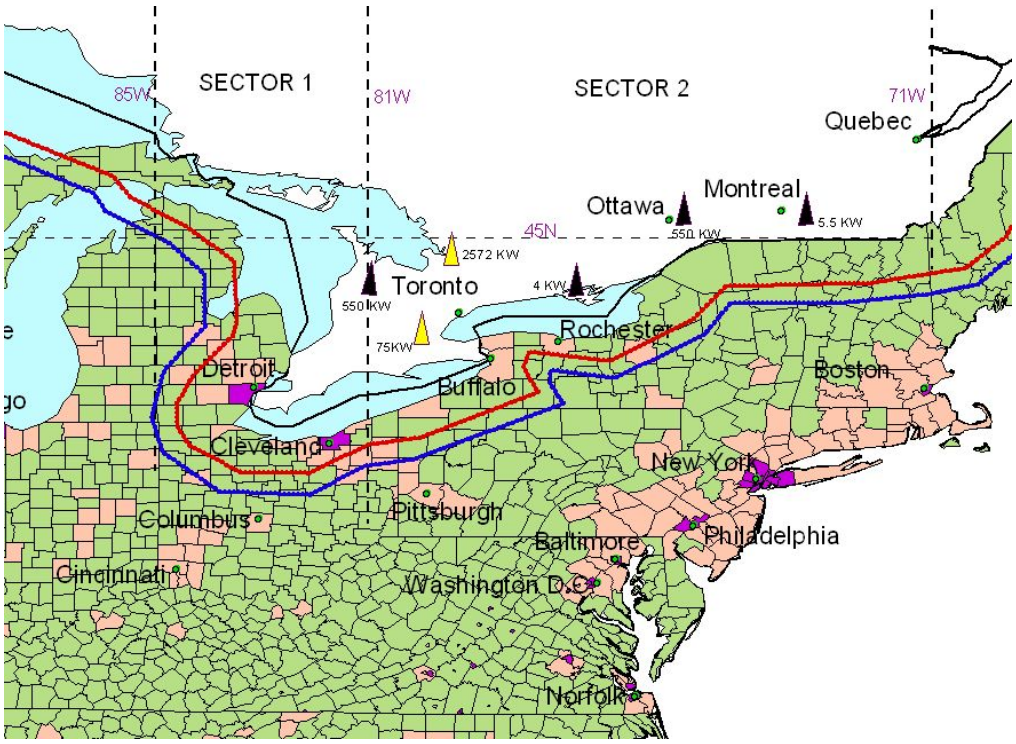

Figure 2 US-Canada Sharing Arrangement and TV 62 and 67 *(not all emitters shown)*

As shown above, protection from and to Canadian TV stations on channels 62 and 67 could significantly hinder public safety broadband operations in border regions.

To resolve these issues, the FNPRM identified a better course – namely, "to allow limited use of the internal guard band in areas along the Canadian border to the extent

[47] Not all emitters are reflected. This is provided as an illustration only until confirmed by either the FCC or Industry Canada. To give an idea of possible interference impact, a county classification was superimposed. Urban, suburban and rural counties are respectively colored in purple, pink and green for rural. County population density was used for the purpose. The approximate size of sharing and protection strips reflect the current international agreement. Depths of the red and blue contours are 100 Km and 140 Km respectively. The Canadian television emitters operating on channel 62 are depicted by black triangle icons and those operating at 67 by yellow icons.

that Canadian broadcasters cause interference to the relocated narrowband channels."[48] As the Commission acknowledges, this approach will result in a corresponding loss of available spectrum for broadband communications because an internal guard band will still be needed to protect the shifted narrowband channels from public safety broadband operations. However, subject to a few exceptions, the border region is not densely populated and there will be some delay in funding and building out these systems regardless. Thus it seems likely that maximum broadband capacity will not be needed immediately. This approach is superior to the creation of a temporary public safety broadband easement into the commercial band, as suggested by the Commission. Thus the easement and the corresponding complexity for commercial and public safety operators should be rejected in favor of the flexible internal guard band described above.

Successful implementation of the policy approach outlined above is also contingent on the ability of the FCC to develop and implement interim and final agreements with Canada. In the absence of a parallel effort by Industry Canada to align Canada's DTV transition process with the United States, public safety broadband in the United States will have to account for Canadian narrowband public safety operations in the lower half of TV channels 63 and 68. More specifically, if no bandplan change is implemented in Canada, non-primary users on one side of the border will have to provide protection to primary users on the other side. Figure 3 illustrates channels assignment for both the United States and Canada per the in-force Sharing Agreement.[49]

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[48] *FNPRM* ¶ 259.

[49] Approximate sizes are shown. I/O channels have been ignored for simplicity of presentation. The share of primary channels allocated to US and Canadian public safety services also differ from sector to sector. In sector 1 Canada has been assigned nearly 500 KHz and the US the remaining 2.5 MHz, while in sector 2 the share distribution is nearly reversed with about 2 MHz for Canada and 1 MHz for the US.

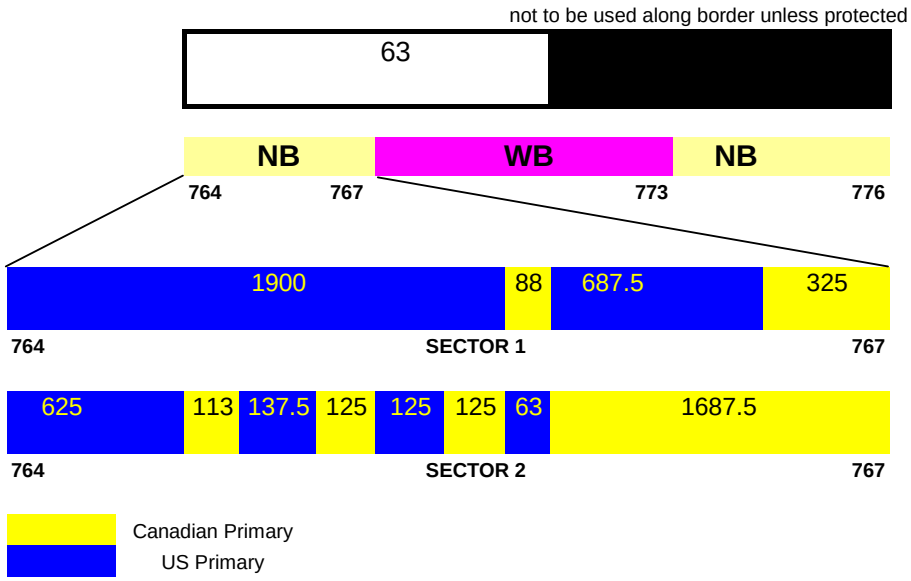

Figure 3 Current Primary Channels Assignments in Sectors 1 and 2

If Canada does not align its band plan with the US, in a timely manner, the deployment of public safety broadband could suffer interference from co-channel narrowband operations and TV activity from across the border, limiting the number of broadband channels that could be deployed along the border.

Although the details of any agreement will be subject to a variety of variables, one possible bandplan for cross-border coordination with Canada is as follows. The unused spectrum in channels 63 and 68 (767-770 MHz/797-800 MHz)[50] could be used equally between both nations while avoiding, for example, the reverse assignment between Sectors. With a reverse assignment, only 3 MHz will be available for broadband utilization whereas with a fixed assignment, as illustrated in Figure 4a,[51] 4 MHz would be

[50] Industry Canada has not yet granted licenses for operation in Canada's 3 MHz-wide wideband block.

[51] For ease of presentation, interoperability, state and other channels are not shown.

available which *may* allow the deployment of up to 3 1.25 MHz broadband channels[52].

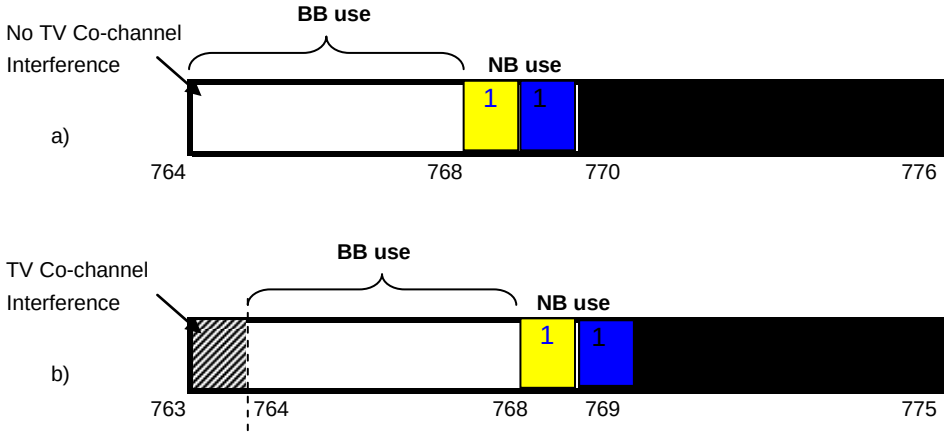

Figure 4 Possible Assignments for Sectors 1 and 2. a) Proposals 1 and 2, b) Proposals 3-5

Interleaving the Canadian block between US public safety broadband and narrowband makes good use of the US spectrum along the border. Either plan will have to account for adjacent TV interference and abide by current technical rules enacted in the international agreement. In any event, it is essential that work on these international issues begin immediately to facilitate rapid roll out of these services.

V. THE COMMISSION SHOULD NOT ADOPT OPEN ACCESS REQUIREMENTS FOR 700 MHz SPECTRUM IN THIS PROCEEDING

The Commission should reject proposals filed by Media Access Project, the Ad Hoc Public Interest Spectrum Coalition, and Frontline that would place a condition on certain licenses in the 700 MHz commercial spectrum requiring a licensee to provide "open access," including the right of a consumer to use any equipment, content,

[52] The use of the pair 769-770 paired with 799-800 by US public safety services, along the border, would imply that 'channel programming' of narrowband radios used by emergency users such as State agencies, or agencies bordering the coordination zones, would have to account for that additional block of frequencies. For example, all state radios would be programmed (channels preset) for at least current State-assigned channels, I/O channels and the additional (TBD) channels defined by an eventual 'interim' sharing agreement.

application or service on a non-discriminatory basis.[53]

First, this is not the appropriate proceeding in which to resolve the many complex issues implicated by "open access." The Commission already has two open proceedings that address the controversial issues raised by wireless open access, such as the interplay among markets, technology, consumer choice, and network management – RM-11361 regarding the Skype petition and the WC Docket No. 07-52 notice of inquiry regarding broadband industry practices. The concept of open access can be more comprehensively examined in those proceedings rather than in a band-specific matter here in the 700 MHz proceeding.

Second, if the Commission chooses to address open access here it should reject calls to create a new unwarranted regulatory mandate in this highly competitive industry. Open access is a regulatory concept in search of a problem to solve. As ALU explained in the Skype proceeding, the wireless broadband market is vibrant and competitive, rapidly evolving and innovating at all layers of the network, with innovative business plans that provide products and services that consumer demand.[54] Each segment of the market (access and service providers, equipment manufacturers – infrastructure and devices – and applications providers) relies on innovation at all levels to provide new features for end-users. The FCC must refrain from imposing any new regulations in this proceeding that might impede innovation at any layer of the wireless broadband network.

VI. CONCLUSION

For the reasons discussed above, the Commission should swiftly designate the public safety wideband spectrum for exclusive broadband use, consistent with a single

[53] *FNPRM* ¶ ¶ 275, 290.

[54] *See Alcatel-Lucent Reply Comments*, RM-11361 at 5(May 15, 2007).

national interoperability standard. With these changes, ALU also supports consolidating the public safety narrowband channels in the upper portion of each block. ALU supports the designation of at least 5 MHz reserved for broadband use and the channelization of that block into multiples of 1.25 MHz. The Commission should also revisit certain technical rules to optimize public safety and commercial operations in the 700 MHz band. Any band plan modifications must accommodate the complexities created by narrowband border operations. Finally, the Commission should reject calls to address "open network" and net neutrality issues in this docket. The Commission faces a historic opportunity to change state and local public safety communications for the better. With these changes, it can seize this opportunity to make the Nation safer for all Americans.

Respectfully Submitted,

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